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# POSSIBLE USE OF IMPROVED WOODS AND WOOD-BASE PLASTICS IN THE FURNITURE INDUSTRY

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# POSSIBLE USES OF IMPROVED WOODS AND WOOD-BASE PLASTICS IN

## THE FURNITURE INDUSTRY<sup>1</sup>

By

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Recent publicity on various improved woods and plastics has raised the question in the furniture manufacturer's mind as to the possibilities of using these materials in furniture. Much research and development by industry, by the Forest Products Laboratory, and by other research organizations is taking place and many significant adaptations and new products have been developed. These products may have a definite place in certain furniture parts, but probably will not be practical for use in furniture as a whole. The extent of their use will depend on the cost and the degree of increased serviceability. Although no definite figures on post-war costs can be determined at the present time, it is apparent that for some applications the increased cost will be small, while for others the increase in raw material and processing costs may be as much as threefold. In certain uses, however, this increased material and assembly cost will be partially offset by a smaller finishing cost.

A brief review of the nature and properties of some of these new materials may aid the furniture manufacturer in deciding which of the new products he might consider for use in the manufacture of his particular product.

### Impreg

"Impreg" is the name given to the general group of resin-impregnated, uncompressed wood; that is, wood that has been treated with phenolic or urea resin-forming systems under conditions such that the resin is formed throughout the intimate structure of the wood. Under such conditions considerable dimensional stability is imparted to the wood. Although phenolic resins are more expensive than urea resins, they reduce the equilibrium swelling to about 30 percent of normal in contrast with a reduction to 60 percent of normal obtainable with urea resins (Forest Products Laboratory Uralloy-C or commercial products of similar characteristics). The urea resins, however, do not discolor wood as do the phenolic resins and thereby make possible the obtaining of truer colors in dyeing at the time of treatment.

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<sup>1</sup>-Published in Wood Products, January 1945; in Retailing Home Furnishings, February 1945.

The chief improvement in the properties of impreg over natural wood for use in furniture appears to be the reduced swelling and shrinking and the accompanying reduction in checking and warping. Phenolic-resin treatment also imparts appreciable decay and termite resistance and chemical resistance to wood. Although neither resin treatment gives fire resistance, incorporating fire-retardant salts with the treating resin will give fire-retardant properties to the product. The only strength properties that are significantly increased by resin treatment are the compressive strength and the hardness, the latter of which may be increased from 50 to 100 percent. This is accompanied by a decrease in toughness. Data on wear resistance are still lacking.

Veneer of almost all species can be used in the manufacture of impreg. With the exception of sapwood of readily treated species, however, solid wood in lengths greater than a foot cannot be adequately treated. In addition, the complete treatment of solid wood will be too expensive for the benefits gained. A surface treatment of solid wood does not improve the properties to the degree that might be expected. It appears, therefore, that resin treatment of wood for furniture will be largely confined to veneer and will not be used on solid wood furniture.

The treatment of surface veneers, especially in the form of fancy crotches and burls, seems well worth while, due to the greatly reduced face checking resulting from the treatment. In matched, fancy, decorative veneers, which are often valued at 50 cents to \$2 per square foot, the resin and treatment cost need not exceed 1 to 2 cents per square foot. Two panels, one with a phenolic-resin-treated crotch veneer face and the other with a matched untreated face, were held under normal room conditions at the Forest Products Laboratory for four years. A vast improvement was noted in the treated panel; for the control contained many face checks, whereas the treated panel was free from face checks.

### Compreg

"Compreg" is resin-treated wood that is compressed prior to the setting of the resin. The specific gravity can vary from that of impreg (about 15 to 20 percent greater than that of the untreated wood) up to 1.4. Compreg has improved properties similar to those of impreg plus a natural glossy surface finish and improved strength properties about in proportion to the compression. When compreg is compressed to a specific gravity of about 1.0 or greater, any cut surface can be sanded and buffed to give a natural, durable, and solvent-resistant finish. The wood is finished throughout, and all that is needed to bring out the finish is making the surface plane. Scratches and mars, therefore, which should only infrequently occur to compreg furniture because of its hardness, can be removed by sanding and buffing and the original finish restored without the necessity of applying a finish.



Compreg can be made from soft, inferior species that normally are not used for furniture and a product obtained equal in appearance and in almost all strength properties to compreg made from birch or maple.

Thick laminated compreg will be too expensive, in general, for furniture. It might be used, however, in special expensive furniture where slender legs are desired as a result of its appreciably increased stiffness. Its greatest application appears to be in face veneers. When some of the softer species are used, partially compressed compreg can be simultaneously compressed and assembled with an untreated wood core in one operation without compressing the core. This is due to the fact that the treated faces are plastic under heat prior to setting of the resin and will, in some woods, compress to about one-half their original thickness under a pressure of only 200 pounds per square inch, which pressure causes a negligible compression of most dry wood cores. A harder surface and higher degree of natural finish can be obtained when the faces are separately compressed to a higher degree and then assembled with the core. When this method is used the compreg surface to be glued must be sanded to give a good glue bond.

Compreg is susceptible to a certain degree of forming prior to setting of the resin in the manufacturing process. Pressing to contour of office and theatre seats is quite possible.

### Staypak

"Staypak" is solid or laminated wood containing no resin within the wood structure and is compressed to a specific gravity of 1.3 to 1.4 under conditions such that it will not tend to spring back under swelling conditions. It is not so resistant to swelling and shrinking as compreg, but is more resistant than normal wood. It has a natural satin finish in contrast to the glossy finish of compreg. It might be used for slender table legs as was suggested for compreg and would be considerably cheaper. It could be used for table tops in both solid and surface veneer form. The stabilizing process darkens the wood to some extent, some woods taking on the color of walnut and some becoming even darker. The only species that should be avoided for making staypak are the resinous pines. Like compreg, staypak upgrades the inferior species; cottonwood, basswood, and alder, for example, give as beautiful and practically as strong a product as birch or maple.

### Hydroxylin

"Hydroxylin" or lignin plastic, as it is sometimes called, is a dark brown to black hydrolyzed-wood plastic made either from sawdust or wood chips in a molding powder or laminating sheet form. The cost, water resistance, and mechanical properties will depend to a large degree on the amount and nature of resin used as a plasticizer. The most water-resistant forms contain some phenolic resin. A product with good properties

is, however, made without the use of critical resin. Because of its dark color, its potential use in furniture manufacture would be principally confined to use as a core material. The hydrolyzed-wood sheets can be laminated with veneer or pigmented resin-treated paper faces. Its specific gravity is about 1.4, similar to fully compressed compreg, staypak, and the paper-base plastics. Although it is not so strong as these other densified materials, it has adequate strength for many furniture uses and should be definitely cheaper.

### Paper-base Plastics

Paper-base plastics have already been used in furniture manufacture for table and counter tops. Beautiful surface laminates with high water and acid resistance have been produced. Surfaces with linen-like appearance are being made entirely from paper-base plastics, using urea or melamine resins and pigmented paper.

Since the war, high-strength paper-base plastics (papreg) have been developed with strength properties adequate for all kinds of furniture manufacture. This material can be laminated and molded to appreciable single curvatures and moderate double curvatures under pressures as low as 50 pounds per square inch. Different colored and textured surfaces can be readily obtained.

A cheaper paper plastic, suitable for core material, can be made by incorporating lignin recovered from the soda pulping process directly with the pulp in the beater, or impregnating the paper with the lignin solution. The addition of some phenolic resin improves the water resistance properties but would not be essential for all furniture uses. This laminate, like the hydroxylin, will be brown to black in color.

Where extreme curvatures are required, resin-bearing preforms of paper pulp can be first formed to approximate shape and then molded to the plastic state in metal dies or with bag-molding procedures. The product, like the paper-base plastic, is strong, tough and durable. One-piece drawers with rounded corners might, for example, be produced by this method.

### Summary

Impreg, compreg, several forms of hydroxylin, various paper-base plastics including papreg and pulp preforms are now manufactured commercially. The hydroxylin alone is available for commercial use at the present time, due to the critical resins used in the other products. Staypak and Uralloy are not manufactured as yet, but several companies are considering commercial production. The furniture manufacturer will thus not be able to take full advantage of these materials until after the war.

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